RELAXED POTENTIALS AND EVOLUTION EQUATIONS FOR MATERIAL DEFECTS

K. Hackl[a]

[a]Institute of Mechanics
Ruhr–University Bochum
Bochum, D–44780 Germany
hackl@am.bi.ruhr-uni-bochum.de

The approach presented is based on density–functions for the distribution of defects. The time–evolution of such distributions is then governd by the global minimization of a corresponding volume–averaged energy–density. The densities are allowed to become singular thus premitting the modelling of crack–formation.

We start from volume–averaged energies depending on distributions of defects and compatible distributions of deformation–gradients. Minimization with respect to the latter yields a relaxed energy which is (approximately) quasiconvex ensuring the corresponding favorable properties such as existence of minimizers for the corresponding boundary–value problem.

Further variation of this relaxed energy with respect to the defect–densities then gives distributions of material forces which can be incorporated into driving mechanisms for the evolution of defects. This leads to evolution equations which possess a formal similarity to those of plasticity theory, apart from the fact that numerical complications are caused by the requirement on the density–functions to be nonnegative everywhere.

Nevertheless it is possible to construct efficient integration–algorithms. Various numerical examples will be presented.

References

[1]K. Hackl, and U. Hoppe, " On the Calculation of Microstructures for Inelastic Materials Using Relaxed Energies", Preprint 02-1, Institute of Mechanics, Ruhr-University Bochum (2002).